

## KIT, AIR DISS & CO<sub>2</sub> YOKE

### INSTALLATION PROCEDURE

NOTE: This procedure outlines an extremely complex modification of the anesthesia machine. Installation of this kit shall be performed only by a North American Dräger qualified Technical Service Representative with the necessary knowledge and experience.

NOTE: This procedure applies to 2-gas machines with earlier tubing arrangements, fluted flow knob guards, and flow control knobs located below the 100 to 1000 ml/min. (fine) flowmeters.

1. Turn the System Power switch to ON and disconnect all pipeline hoses.
2. Close all cylinder valves except the O<sub>2</sub> cylinder valve.
3. Set the oxygen flow rate to 5 l/min.
4. Open the N<sub>2</sub>O flow control valve to drain pressure from the system.
5. Close the O<sub>2</sub> cylinder valve, and close the flow control valves. Press the O<sub>2</sub> FLUSH button to drain pressure from the system.
6. Turn the System Power switch to STANDBY and remove AC power from the machine. Disable all circuit breakers.
7. Remove the screws securing the table top, and remove the table top.
8. Remove the flowmeter housing back cover.

CAUTION: Use ESD control when handling any electronic components or assemblies.

9. Remove the vapor box front cover.  
  
For machines with a Multispec analyzer, remove all connections to the PCB assembly on the vapor box front plate, and remove the PCB from the plate.
10. Remove the vapor box back cover.
11. Remove the screws holding the angled front plate at the top of the flowmeter shield, and remove the plate.
12. Remove all flow control knobs.
13. Remove the two screws securing the knob guard; remove the guard and the flowmeter shield.

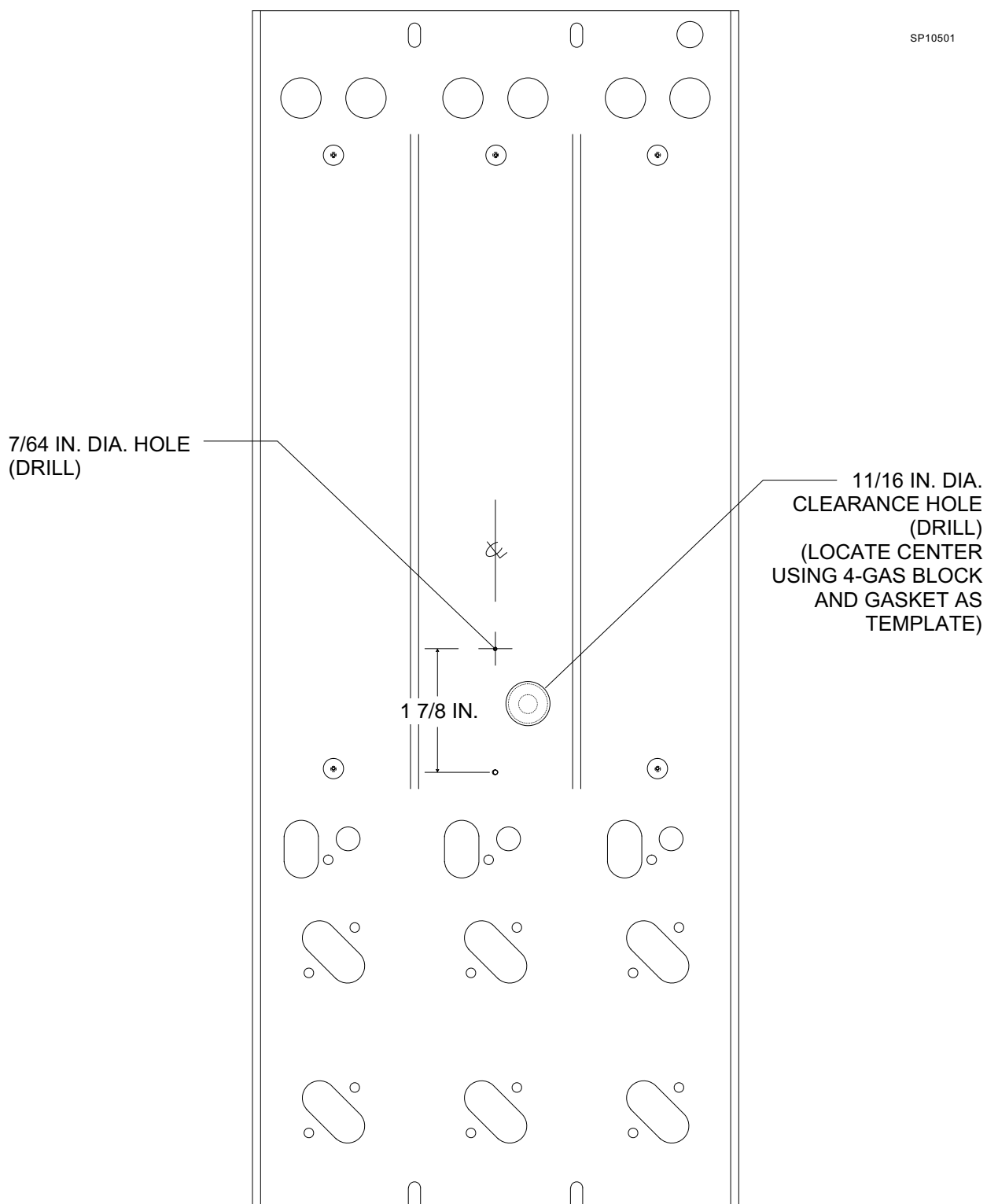
<b>INSTALLATION PROCEDURE (continued)</b>
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CAUTION: Use ESD control when handling any electronic components or assemblies.

14. Remove the flowmeter lights PCBs and channels from the studs on the O<sub>2</sub> and N<sub>2</sub>O flow channels.
15. Remove the stop pin hex nuts from each flow control valve.
16. Remove the flow control valves: hold each at the wrench flats and turn it counter-clockwise.
17. Remove each flowmeter tube by turning its retaining insert at the top of the assembly counter-clockwise until there is enough clearance to remove the tube from the channel.
18. Disconnect the flex tubing connected to the N<sub>2</sub>O restrictor housing, and remove the O<sub>2</sub> and N<sub>2</sub>O restrictor assemblies.
19. Remove the cross-over tubes connecting the O<sub>2</sub> and N<sub>2</sub>O fine and coarse flowmeter ports.
20. Remove the manifold assembly connected to the O<sub>2</sub> and N<sub>2</sub>O outlets at the top of the flowmeters.
21. Disconnect the 4-way fitting and restrictor assembly's lower copper tube from the O<sub>2</sub> flowmeter inlet port.
22. Disconnect the copper tube attached to the N<sub>2</sub>O flowmeter valve port.
23. Disconnect the copper tubes from the O<sub>2</sub> and N<sub>2</sub>O cylinder gauges.

24. Remove the three socket head cap screws securing the bottom flowmeter block to the channel assembly.
25. Pull the bottom block forward, disconnect the small diameter flex tubing from the block, and remove the block.
26. Disconnect the flex tubing from the O<sub>2</sub> and N<sub>2</sub>O pipeline gauges.
27. Remove the three socket head cap screws securing the flowmeter assembly, and remove the assembly.
28. Remove the kep nuts securing the cylinder and pipeline gauges to the flowmeter channel and remove the gauges.
29. Remove the socket head cap screws securing the top block to the channel assembly.
30. Apply masking tape to the raised surfaces of and the entire inside area of the center flowmeter channel to prevent scratching.
31. Temporarily attach the 4-gas bottom block to the channel with the screws that were previously removed from the original block.
32. Using the bottom block as a template, mark the circumference of the 4th gas flow control housing onto the channel: (Insert a flowmeter gasket (P/N 4102725) into the housing. This will provide a smaller diameter hole to aid in locating the center point.) The hole location is shown in Figure 1.

**INSTALLATION PROCEDURE (continued)**



**Figure 1: DRILLING LOCATIONS: 4-GAS CONVERSION**

<b>INSTALLATION PROCEDURE (continued)</b>
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33. Remove the 4-gas bottom block and centering gasket.

**CAUTION:**

Perform the next four steps in a suitable location away from the anesthesia machine to prevent drilling chips from entering the pneumatic system.

34. Center punch the marked hole and drill an 11/16 in. dia. hole into the flowmeter channel. A hole saw is recommended. De-burr any sharp edges.

35. Measure and mark a location 1 7/8 in. up from the lower center spacer hole, and centered in the channel as shown in Figure 1.

36. Carefully drill a 7/64 in. dia. hole at this location, and de-burr any sharp edges.

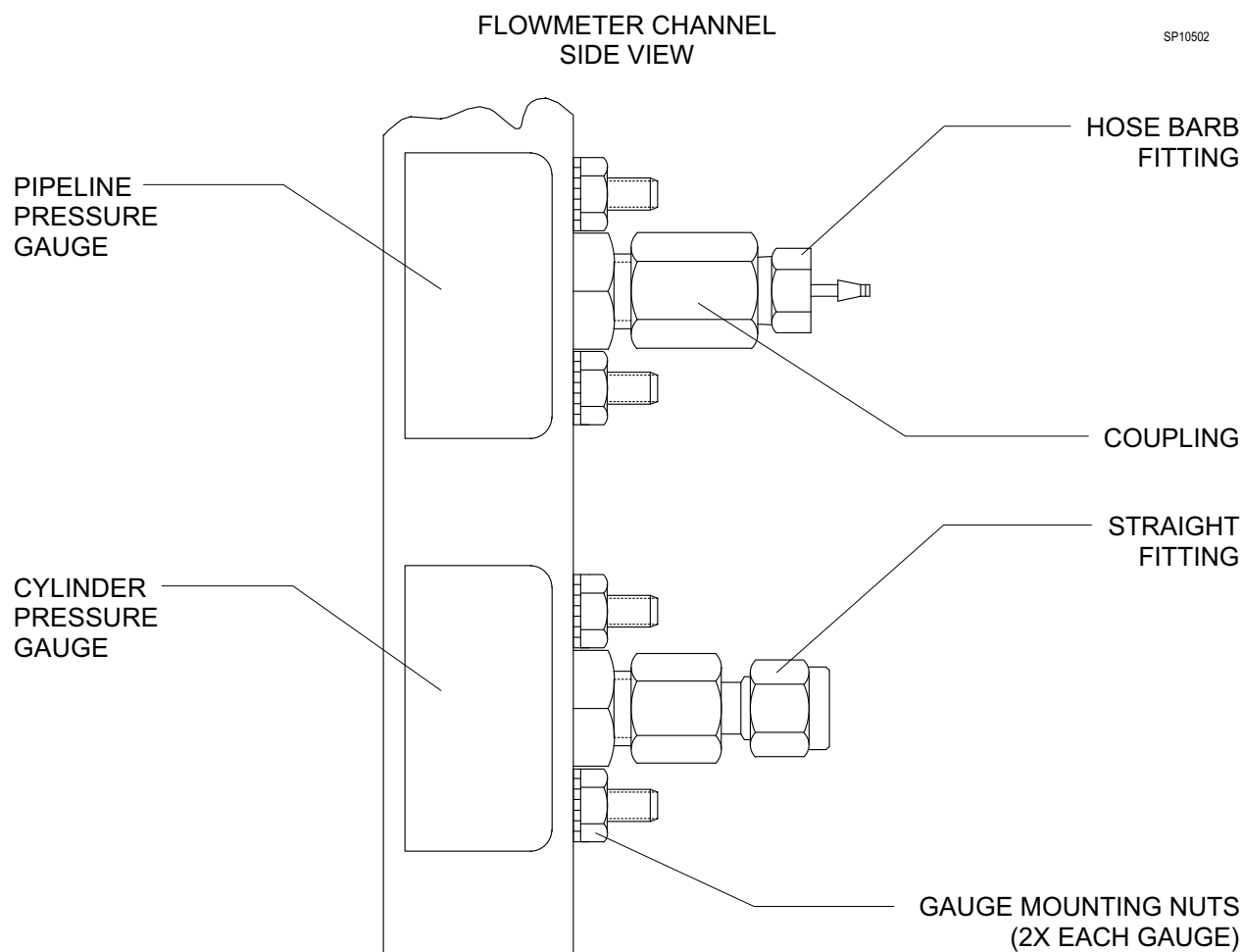
37. Remove all masking tape previously applied, and carefully clean up any metal chips from the flowmeter assembly and surrounding area.

38. Using a small amount of Loctite #271 (red), thread a 3/16 in. tube straight fitting (P/N 4109402) into the back of a high pressure gauge (P/N 4110575-002).

39. Apply a small amount of Loctite #271 (red) to the threads of a 1/16 in. hose barb (P/N 4111771) and pipeline pressure gauge (P/N 4110575-001). Assemble the fittings with coupling (P/N 4103668) as shown in Figure 2.

**INSTALLATION PROCEDURE (continued)**

40. Place the pipeline gauge assemblies into the upper holes of the gauge channel and secure each gauge with two 10-32 kep nuts (P/N HW55002 x2). See Figure 2. Reuse the original hardware to secure the O<sub>2</sub> and N<sub>2</sub>O gauges.
41. Place the cylinder gauge assemblies into the lower holes of the gauge channel and secure each gauge with two 10-32 kep nuts (P/N HW55002 x2). Reuse the original hardware to secure the O<sub>2</sub> and N<sub>2</sub>O gauges.

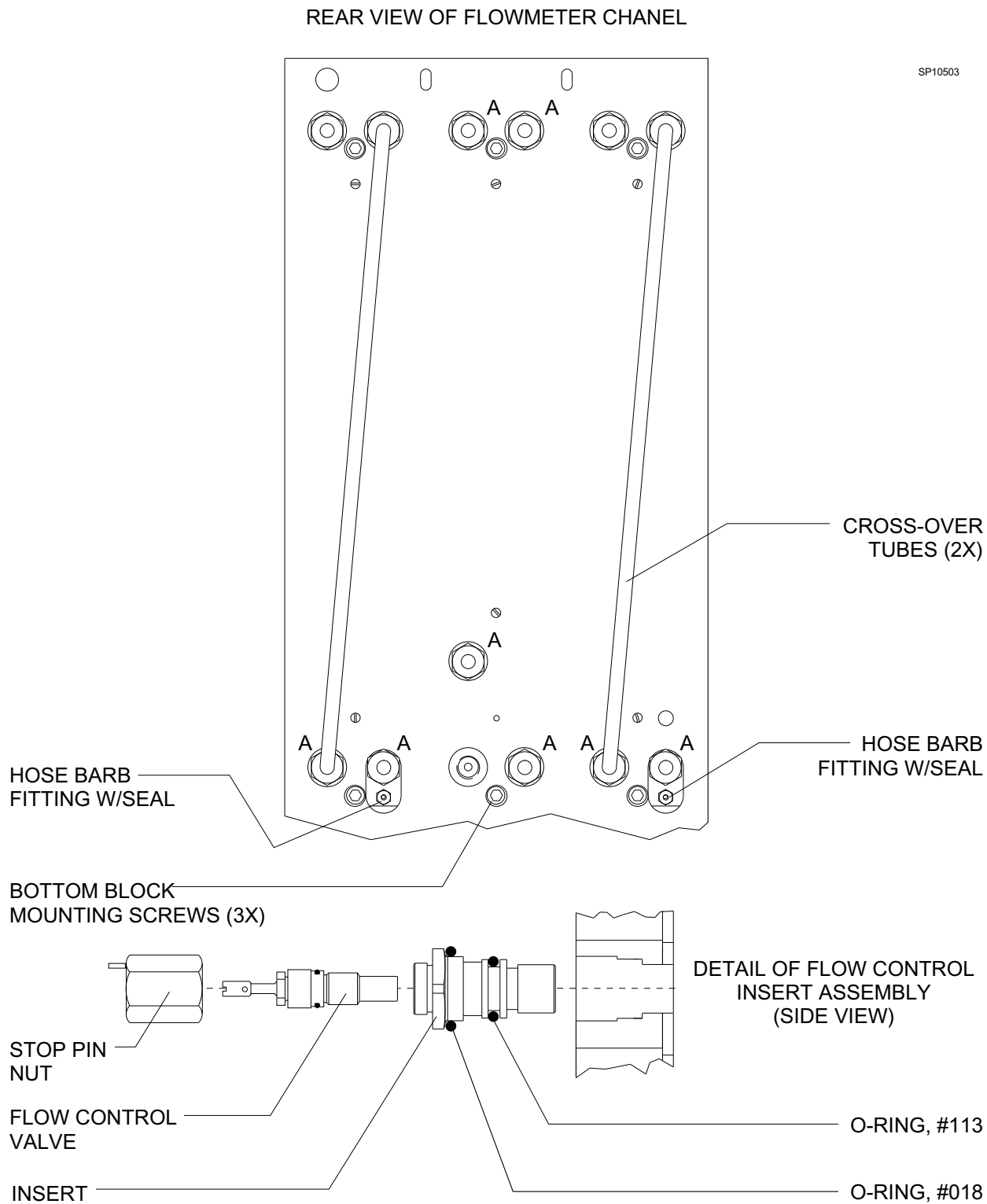


**Figure 2: PIPELINE AND CYLINDER GAUGE ASSEMBLY AND MOUNTING**

<b>INSTALLATION PROCEDURE (continued)</b>
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| <p>42. Apply a small amount of Loctite #271 (red) to the threads of two 2-56 x 1/4 in. pan head screws (P/N HW02000 x2). Place a #2 lock washer (P/N HW67012 x2) on each screw, and secure the two shoulder spacers (P/N4110843 x2) to the inside of the center flowmeter channel.</p> <p>43. Reinstall the top block assembly to the flowmeter channel using the hardware previously removed.</p> <p>44. Thread two inserts (P/N 4102506 x2) into the center locations of the top flowmeter block until snug.</p> <p>45. Secure the 4-gas bottom block (P/N 4110572) to the flowmeter channel using the hardware previously removed from the original block.</p> <p>46. Install a #018 O-ring (P/N 4102336 x4) at the shoulder of each of the four bottom flowmeter inserts (consisting of P/N 4110576 x3 and 4110573) as shown in Figure 3.</p> | <p>47. Install a #113 O-ring (P/N 4102792 x4) in the groove of each flowmeter insert on all four inserts. Apply a small amount of Parker Super-O-Lube to these O-rings.</p> <p>48. Thread the chromed flowmeter insert into the upper hole of the bottom block, and the remaining brass inserts into the lower holes until snug. DO NOT overtighten the inserts.</p> <p>49. Install the flow control valves (P/N 4103352 x2) into the flowmeter inserts. Reuse the original O<sub>2</sub> and N<sub>2</sub>O flow control valves. CAUTION: Before tightening the cartridge, rotate the valve shaft several turns counter-clockwise to prevent bottoming the valve element into the seat when the cartridge is tightened.</p> <p>50. Install the stop pin nuts (P/N 4103382 x2) onto the flow control assemblies. Reuse the original stop pin nuts for the O<sub>2</sub> and N<sub>2</sub>O assemblies.</p> <p>51. Thread two 10-32 x 1/16 in. hose barb fittings w/seal (P/N 4112707-001 x2) into the back of the bottom flowmeter block.</p> <p>52. Remove the nuts and ferrules from eight 1/4 in. tube straight fittings (P/N 4109408 x8). Apply a small amount of Loctite #271 (red) to the threads of each fitting, and thread the fittings into the top and bottom blocks at the locations marked A Figure 3.</p> |
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**INSTALLATION PROCEDURE (continued)**

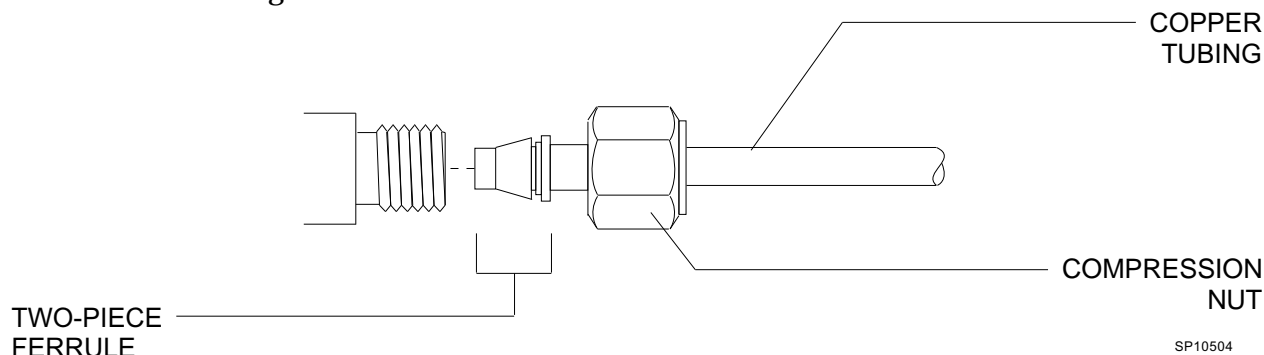


**Figure 3: INSTALLATION OF FITTINGS AND FLOW CONTROL VALVE INSERT ASSEMBLY**

## INSTALLATION PROCEDURE (continued)

53. Assemble the compression fittings onto the open ended tubes on the 4-gas manifold assembly (consisting of P/Ns 4108483, 4109408 x4, 4109410, 4110834-009 x3, and 4110837-013 x2) as shown in Figure 5. Ensure that the Swagelok fittings with the two-piece ferrules are assembled as shown in Figure 4.

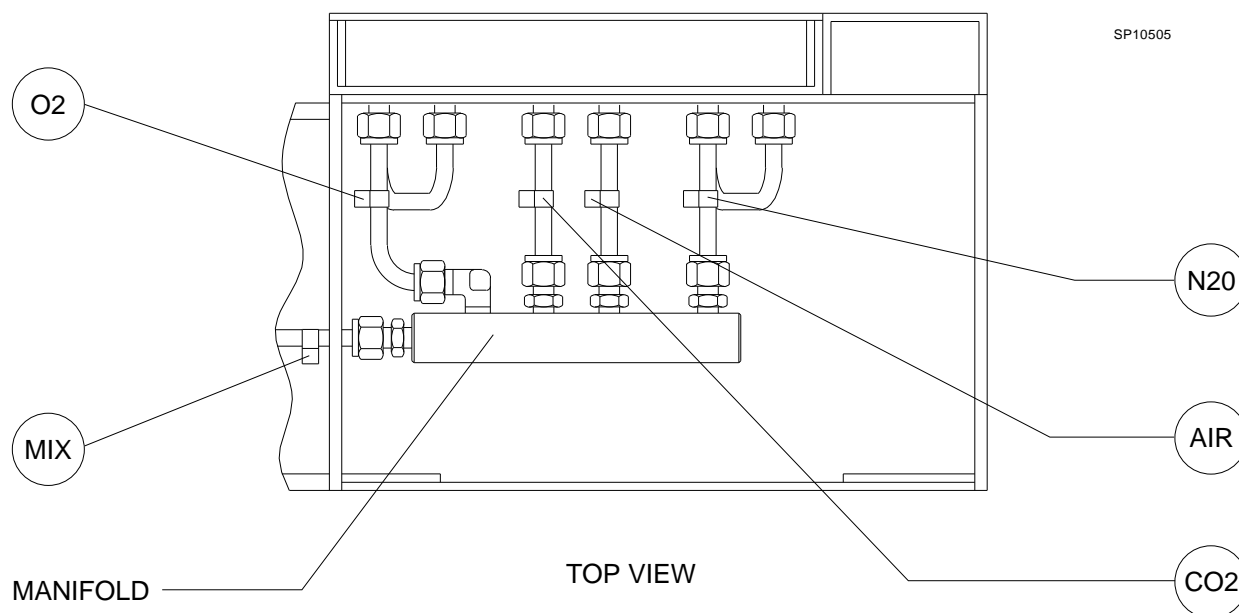
Insert the copper tubes into the manifold assembly as shown in Figure 5. Before tightening the compression nuts, ensure that the tubing is inserted into the fittings as far as possible.



**Figure 4: ASSEMBLY OF SWAGELOK FITTINGS**

54. Attach the copper tubes on the manifold assembly on the ports at the top of the flowmeter bank as shown in Figure 5. Ensure that the tubing is inserted into the fittings as far as possible, and tighten the compression nuts.

55. Attach the correct gas-identifying label (P/N 4109871, 4109872, 4109873, 4109874, and 4109901) to each tube on the manifold assembly as shown in Figure 5.

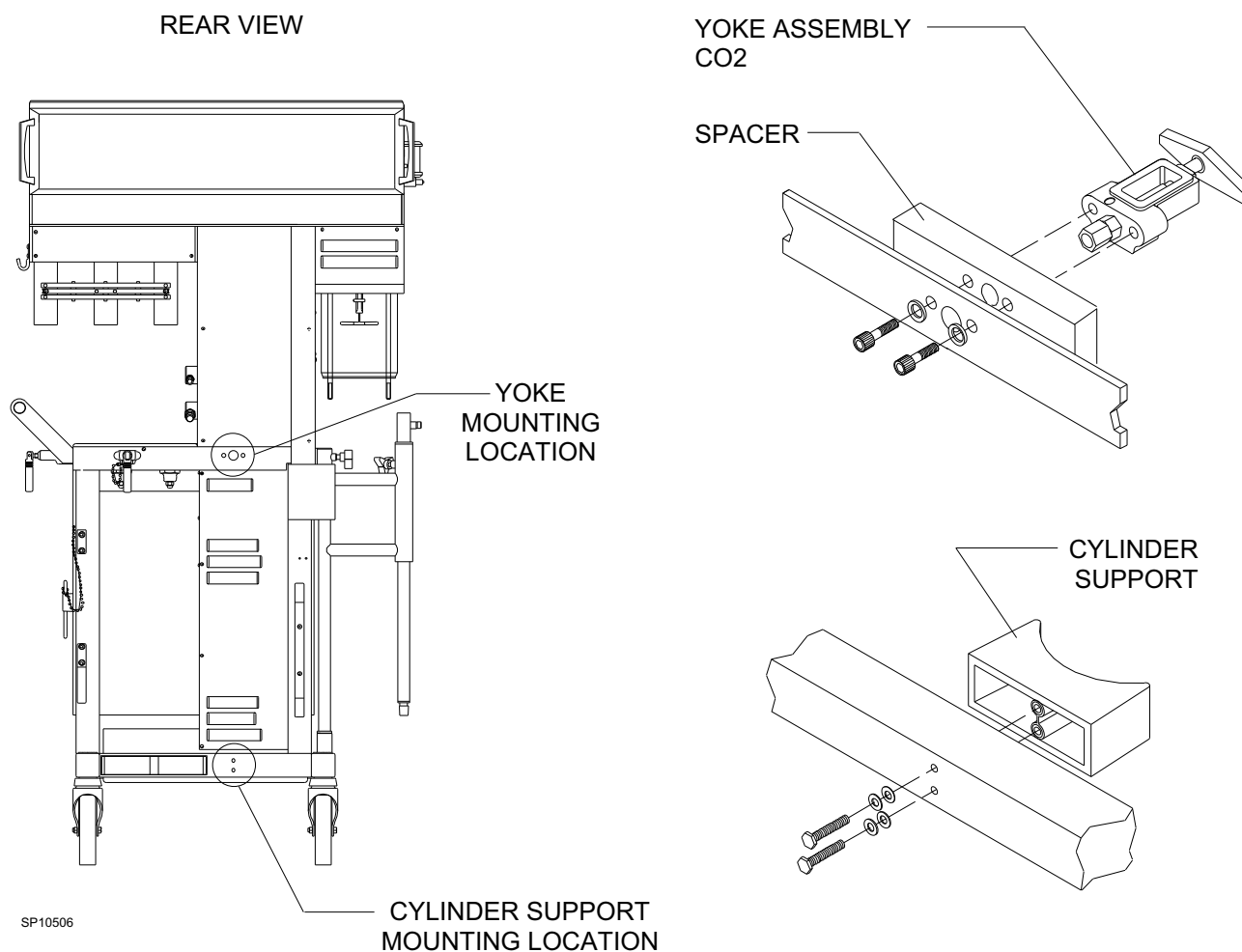


**Figure 5: FOUR GAS MANIFOLD ASSEMBLY WITH LABELS**



## INSTALLATION PROCEDURE (continued)

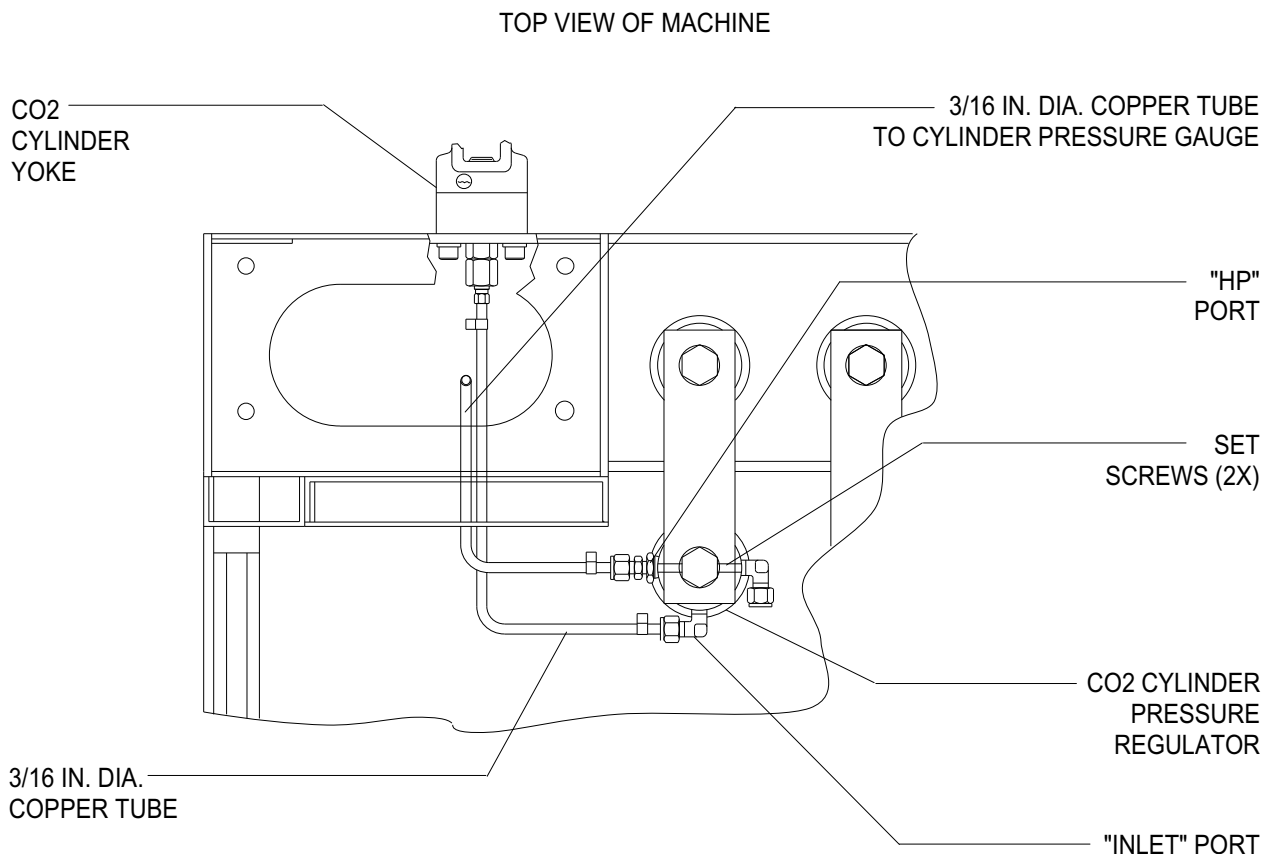
56. Reinstall the flowmeter channel assembly using the hardware previously removed.
57. Reinstall the cross-over tubes connecting the oxygen and nitrous oxide fine and coarse flowmeters. Verify that the correct identification labels are attached to each tube.
58. Mount the cylinder support (P/N 4106690) on the bottom frame rail at the back of the machine (see Figure 6) using two ¼-20 x 2½ in. hex head screws (P/N HW08009 x2), lock washers (P/N HW65010 x2) and flat washers (P/N HW66004 x2).
59. Mount the CO<sub>2</sub> yoke assembly (consisting of P/Ns 4111792, HW06006, 1101624, 4104716, 4105929 x2, and 4112755-001), (and spacer block (P/N 1101593) on earlier models) on the upper frame rail of the machine as shown in Figure 6. Use two 5/16-24 x 1¾ in. socket head screws (P/N HW01058 x2) and lock washers (P/N HW65005 x2). Apply a CO<sub>2</sub> label (P/N 1101639) on this yoke.



**Figure 6: CO<sub>2</sub> YOKE AND CYLINDER SUPPORT MOUNTING LOCATIONS**

## INSTALLATION PROCEDURE (continued)

60. Position the CO<sub>2</sub> cylinder pressure regulator assembly (consisting of P/Ns 4103591, 4109415, 4102906 x2, 4109409, and 4109401) as shown in Figure 7, with the Inlet marking toward the front of the machine.
61. Install two 10-32 x ½ in. set screws (P/N HW10001 x2) in the regulator mounting bracket and secure the regulator.
62. Connect a 3/16 in. dia. (P/N 4104215) pre-bent copper tube between the CO<sub>2</sub> cylinder yoke and the inlet fitting on the CO<sub>2</sub> cylinder regulator.
63. Connect a 3/16 in. dia. (P/N 4104214) pre-bent copper tube between the CO<sub>2</sub> cylinder gauge and the port marked "HP" on the CO<sub>2</sub> cylinder regulator. Ensure that the tubing is inserted correctly, and tighten the fittings securely. Install a CO<sub>2</sub> label (P/N 4109873 x2) on each end of this tube.

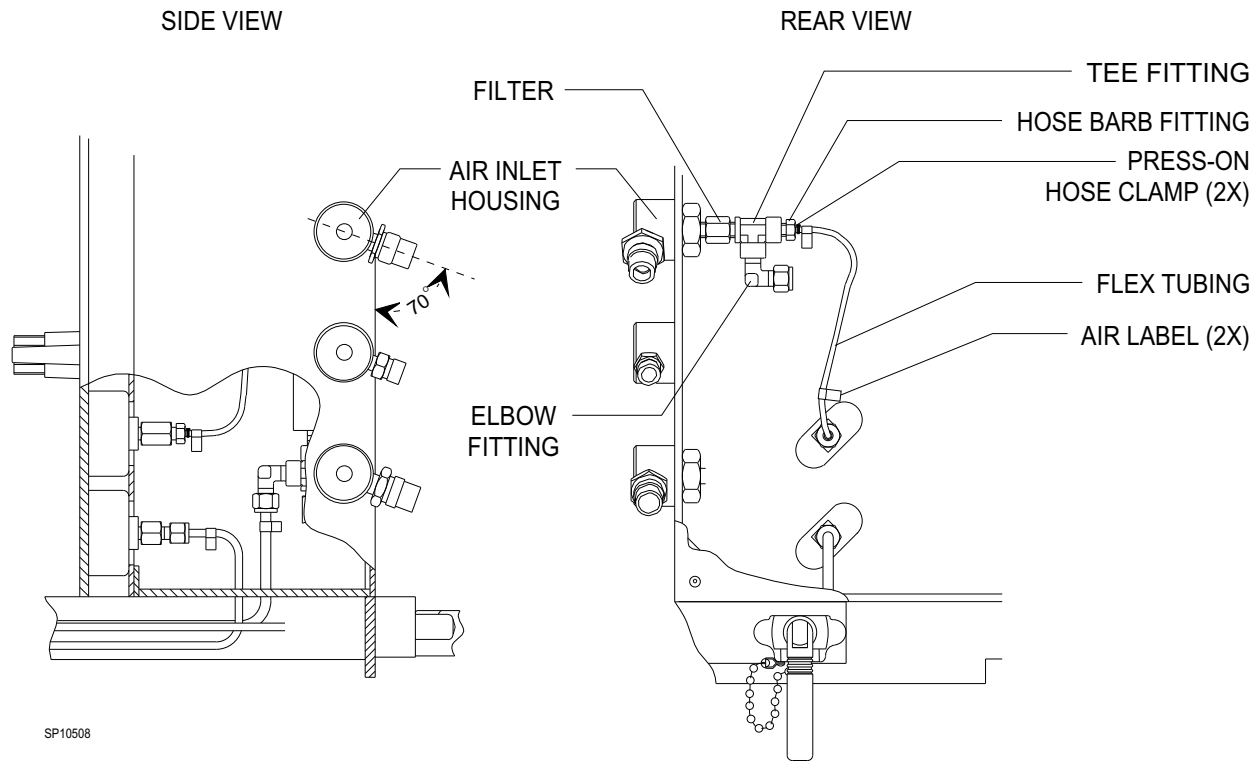


**Figure 7: CO<sub>2</sub> CYLINDER REGULATOR MOUNTING AND H.P. CONNECTIONS**

# **INSTALLATION PROCEDURE (continued)**

64. Reattach the copper tubes previously removed from the O<sub>2</sub> and N<sub>2</sub>O cylinder gauges, and tighten the fittings securely. Verify that the gas identification labels are correct.
65. Reattach the ¼ in. dia. copper tubes previously removed from the O<sub>2</sub> and N<sub>2</sub>O flow control valve ports and the top flowmeter blocks, and tighten the fittings securely.
66. Remove the ¾ in. dia. plastic plug from the flowmeter housing directly above the O<sub>2</sub> pipeline inlet assembly.
67. Install a DISS air inlet housing assembly (consisting of P/Ns 4113363 and 4102886) in the hole where the plug was removed, using a ⅝-18 hex nut (P/N HW52002) and lock washer (P/N HW67001). Orient the DISS connector at a 70° angle as shown in Figure 8. Apply an AIR label (P/N 4102742) to the inlet housing.
68. Apply a small amount of Loctite #271 (red) to the threads of the filter assembly (consisting of P/Ns 4102532 and 4106897) and install it into the air inlet housing.
69. Apply a small amount of Loctite #271 (red) to the threads of tee fitting (P/N 4102760). Install it into the filter assembly as shown in Figure 8, with its side port facing downward.
70. Apply a small amount of Loctite #271 (red) to the threads of a ⅜ NPT x 1/16 in. hose barb fitting (P/N 4111771). Install it into the end port of the tee as shown in Figure 8.
71. Remove the nut and ferrules from ¼ in. tube to ⅜ NPT elbow fitting (P/N 4109410). Using a small amount of Loctite #271 (red) install it in the remaining port as shown in Figure 8. Reattach the nut and ferrules on the fitting (ref. Figure 4).
72. Install an 8 in. length of flex tubing (P/N ML08003 x8) between the air pipeline gauge and the hose barb fitting installed in the previous step. Secure each end of the tubing with a press-on clamp (P/N 4104161 x2), and install an AIR label (P/N 4109872 x2) on each end of this tube.
73. Reattach the flex tubing previously removed from the O<sub>2</sub> and N<sub>2</sub>O pipeline gauges. Secure the connections with the press-on clamps previously removed (use tie straps P/N 4106068 x2 for early style nylon fitting), and verify that the gas identification labels are correct.
74. Remove the ¼ in. x 10-32 plug from the left port of the 4-way fitting and restrictor assembly, and insert a 10-32 x 1/16 in. hose barb fitting w/seal (P/N 4112707-001) into this port.

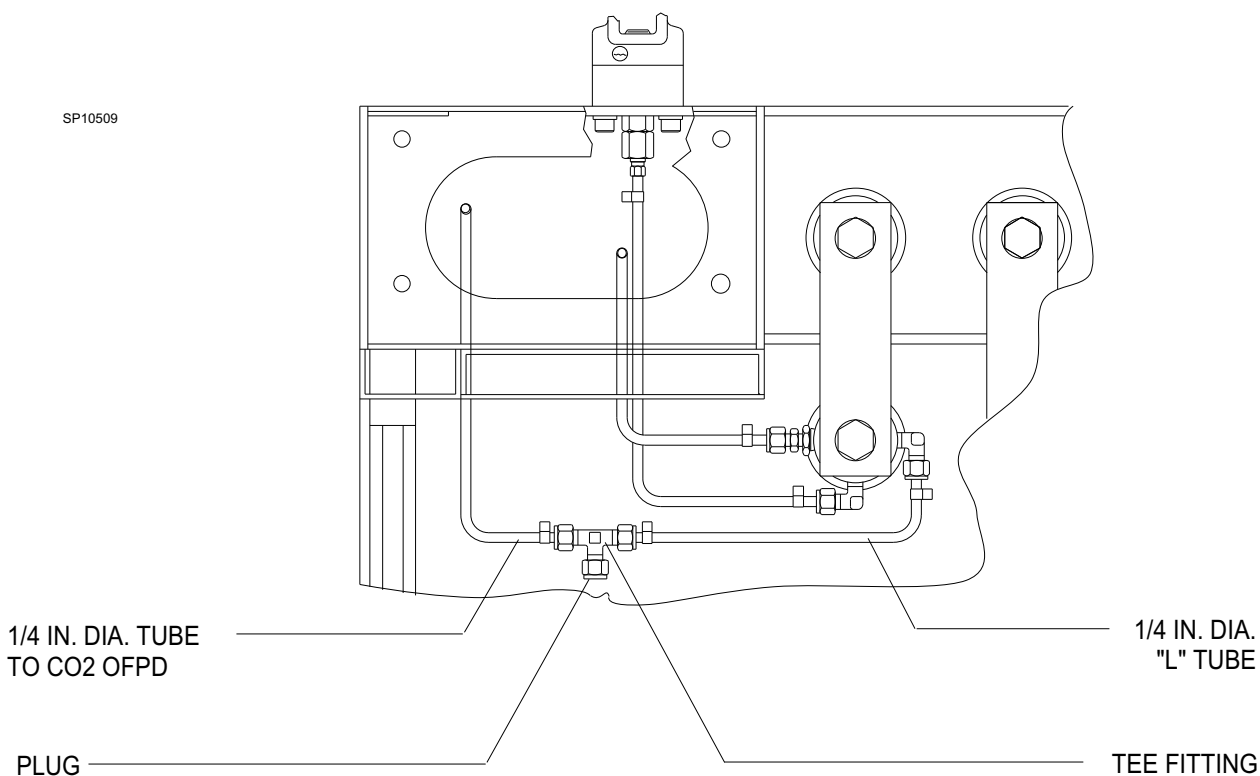
**INSTALLATION PROCEDURE (continued)**



**Figure 8: AIR PIPE LINE INLET ASSEMBLY**

## INSTALLATION PROCEDURE (continued)

75. Connect the short end of a ¼ in. dia. "L" tube (P/N 4110837-015) to the CO<sub>2</sub> cylinder pressure regulator as shown in Figure 9. Install a CO<sub>2</sub> label (P/N 4109873 x2) on each end of this tube.
76. Connect the other end of the "L" tube to a ¼ in. T fitting (P/N 4108636), and install a ¼ in. plug (P/N 4103072) in the side port of the T fitting, and tighten the fittings securely.
77. Connect the short end of a ¼ in.dia. pre-bent tube (P/N 4110279) to the remaining port on the tee fitting as shown in Figure 9. Install a CO<sub>2</sub> label (P/N 4109873 x2) on each end of this tube.

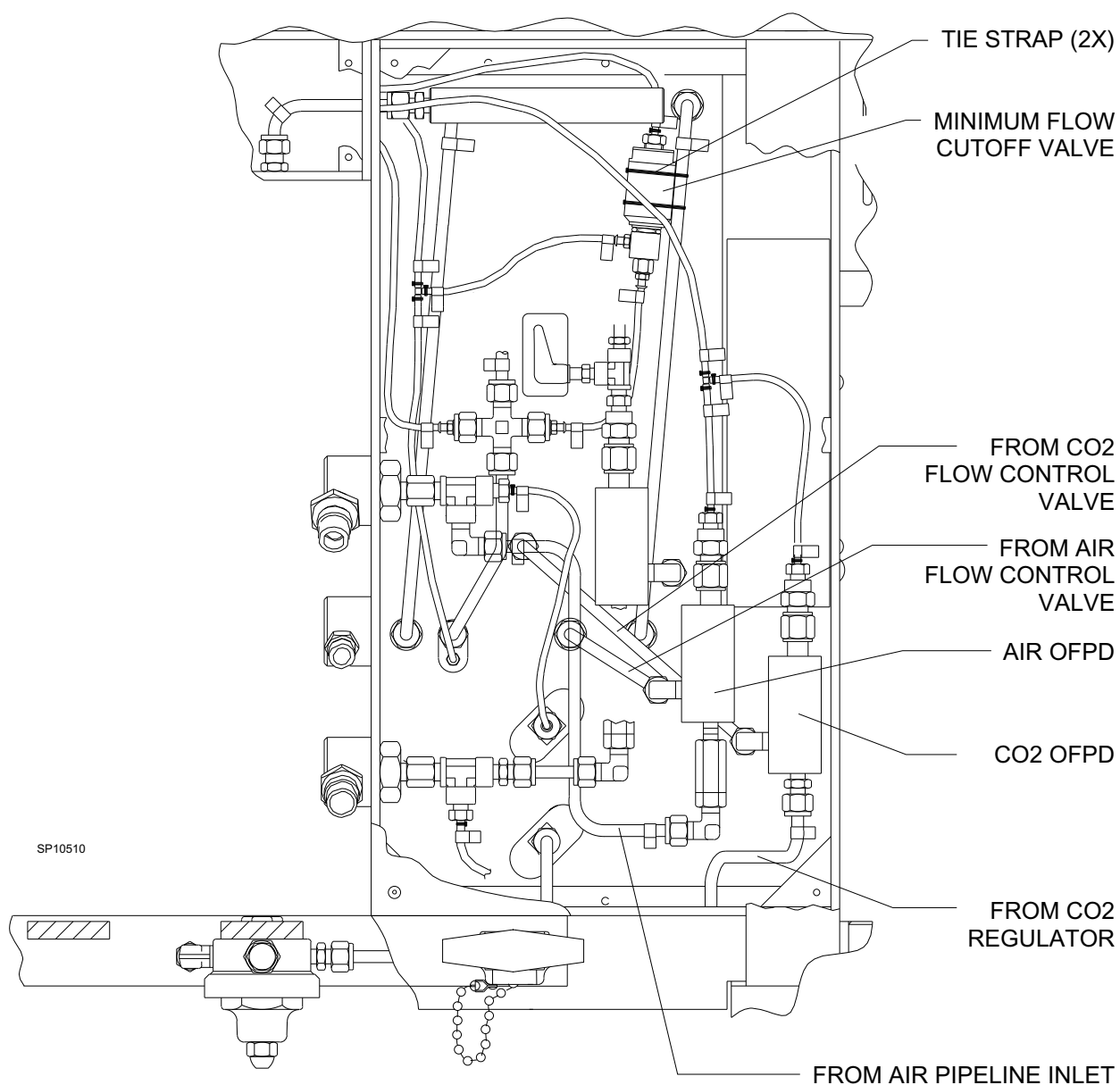


**Figure 9: CO<sub>2</sub> CYLINDER REGULATOR L.P. CONNECTIONS**

<b>INSTALLATION PROCEDURE (continued)</b>
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| <p>78. Connect either end of a ¼ in.dia. S tube (P/N 4110836-006) to the CO<sub>2</sub> flow control valve port. See Figure 10. Install a CO<sub>2</sub> label (P/N 4109873 x2) on each end of this tube.</p> <p>79. Position the CO<sub>2</sub> OFPD (consisting of P/Ns 4111771, 4103681, 4102713, 4109408, and 4109410) in the flowmeter housing and connect the side fitting on the OFPD to the previously installed S tube from the CO<sub>2</sub> flow control valve. Tighten the fittings securely</p> <p>80. Connect the bottom fitting on the CO<sub>2</sub> OFPD to the copper tube from the CO<sub>2</sub> regulator that was previously installed. Tighten the fittings securely.</p> | <p>81. Position the Air OFPD (consisting of P/Ns 4111771, 4103681, 4102713, 4102784, 4015815, and 4109410 x2) in the flowmeter housing and connect an S tube (P/N 4110836-004) between the Air flow control valve and the side fitting on the OFPD. Tighten the fittings securely. See Figure 10. Install an AIR label (P/N 4109872 x2) on each end of this tube.</p> <p>82. Connect a copper tube (P/N 4108803) between the air pipeline inlet assembly elbow fitting and the elbow fitting at the lower end of the check valve on the Air OFPD, and tighten the fittings securely. Install an AIR label (P/N 4109872 x2) on each end of this tube.</p> <p>83. Attach the minimum flow cutoff valve assembly (consisting of P/Ns 4111771, 4102055, 4110792-013, 4103549, and 4112707-001 x2) to the N<sub>2</sub>O flowmeter crossover tube with two tie straps (P/N 1101732 x2) as shown in Figure 10.</p> |
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**INSTALLATION PROCEDURE (continued)**



**Figure 10: OFPD AND MINIMUM FLOW VALVE INSTALLATION**

## INSTALLATION PROCEDURE (continued)

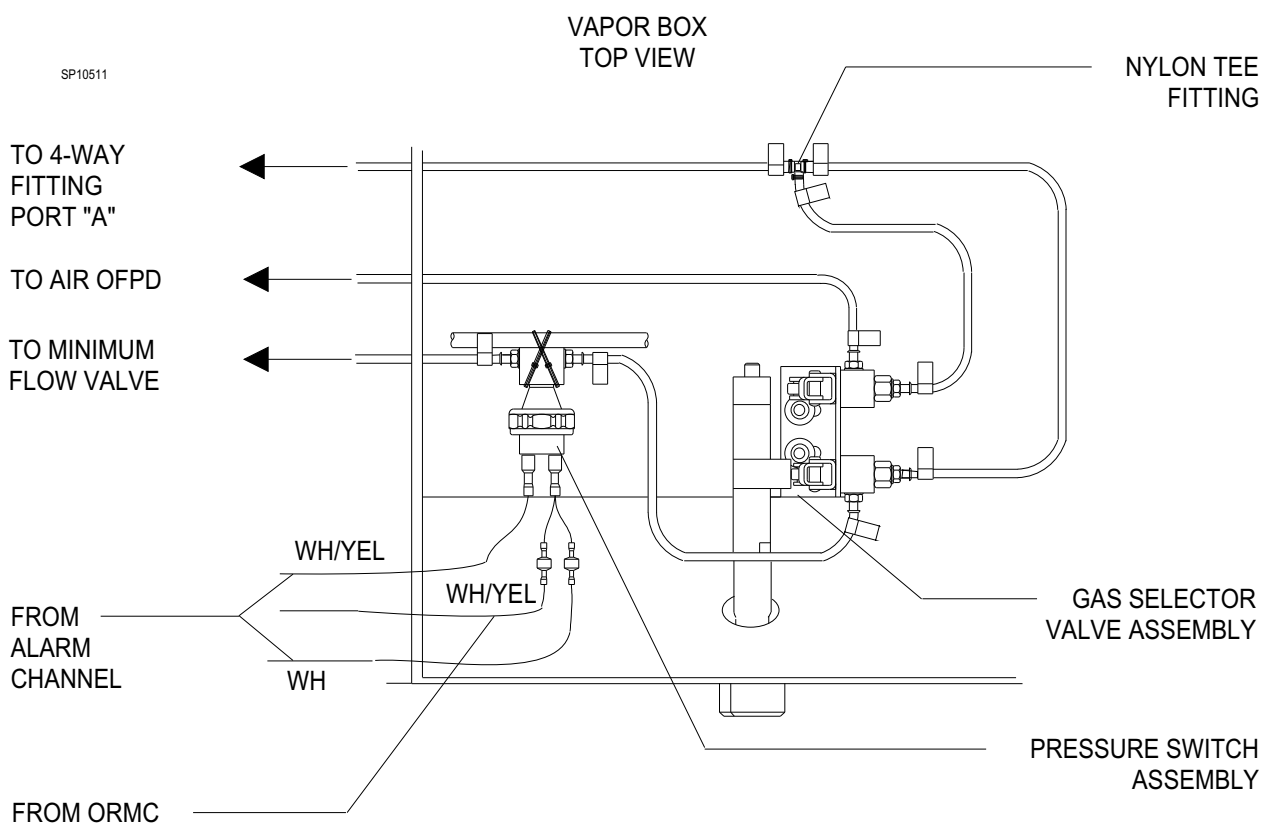
84. Mount the gas selector valve (consisting of P/Ns 4112707-001 x4, HW02028 x2, 4108749 x2, 4103621 x2, and 4110518) to the floor of the vapor box, oriented as shown in Figure 11, with two 10-32 x 5/16 in. socket head screws (P/N HW01022 x2), lock washers (P/N HW67006 x2) and flat washers (P/N HW66003 x2).

### NOTE:

Skip the next nine steps if the ORMC does not have a wire harness and switch.

85. Secure the pressure switch assembly (consisting of P/Ns 4103444, 4106367, and 4112707-001 x2 to the copper tubing in the vapor box with two tie straps (P/N 1101732 x2) as shown in Figure 11.

86. Disconnect all wires from the ORMC wire harness adapter.
87. Attach the female connector of the ORMC wire harness adapter to the terminal on the right side of the pressure switch.
88. Attach the female connectors of the AIR OPT/PRESS SW wire harness (P/N 4106324) to the male connectors on the wire harness adapter.
89. Connect the WHT/YEL wire from the ORMC to the AIR OPT/PRESS SW wire harness.
90. Connect the WHT wire from the alarm channel to the remaining terminal on the AIR OPT/PRESS SW wire harness.



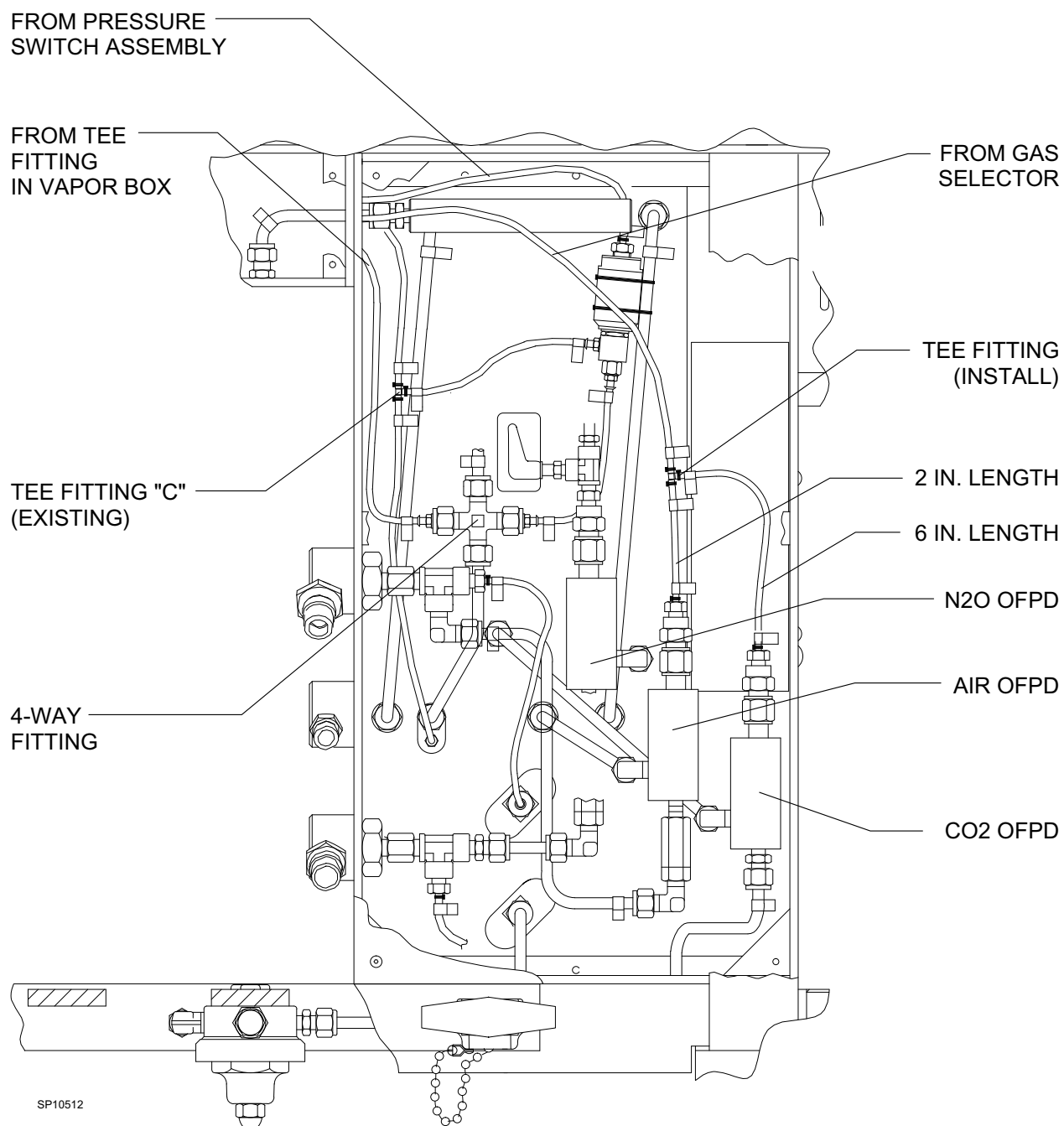
**Figure 11: GAS SELECT VALVE AND PRESSURE SWITCH CONNECTIONS**



## INSTALLATION PROCEDURE (continued)

91. Connect the WHT/YEL wire from the alarm channel harness to the remaining terminal on the pressure switch assembly.
  92. Install a 16 in. length of flex tubing (P/N ML08003 x16) between the right side port of the pressure switch and the front port on the gas selector switch assembly. Secure each end of the tubing with a press-on clamp (P/N 4104161 x2). Install an O<sub>2</sub> label (P/N 4109871 x2) on each end of this tube.
  93. Connect a 14 in. length of flex tubing (P/N ML08003 x14) to the left side port of the pressure switch in the vapor box, and secure it with a press-on clamp. Connect the other end of the tubing to the top hose barb on the minimum flow valve and secure it with a press-on clamp (P/N 4104161 x2). Install an O<sub>2</sub> label (P/N 4109871 x2) at each end of this tube.
- NOTE: Skip the next step if the ORMC has a wire harness and switch.
94. Connect a 33 in. length of flex tubing (P/N ML08003 x33) between the front port on the gas selector switch and secure it with a press-on clamp. Connect the other end of the tubing to the top hose barb on the minimum O<sub>2</sub> flow valve and secure it with a press-on clamp (P/N 4104161 x2). Install an O<sub>2</sub> label (P/N 4109871 x2) at each end of this tube.
  95. Connect an 8 in. length of flex tubing (P/N ML08003 x8) from the side port of the rear valve on the gas selector and secure it with a press-on clamp (P/N 4104161). Connect the other end of the tubing to the center port of the nylon tee fitting (P/N 4102337), and secure it with a tie strap (P/N 4106068). Install an O<sub>2</sub> label (P/N 4109871 x2) on each end of this tube.
  96. Connect an 11 in. length of flex tubing (P/N ML08003 x11) to the side port of the front valve on the gas selector, and secure it with a press-on clamp (P/N 4104161). Connect the other end of the tubing to the nylon tee fitting installed in the previous step, and secure the connection with a tie strap (P/N 4106068). Install an O<sub>2</sub> label (P/N 4109871 x2) on each end of this tube.
  97. Connect a 24 in. length of flex tubing (P/N ML08003 x24) from the rear port on the gas selector assembly to the hose barb on the top of the air OFPD in the flowmeter housing. See Figures 11 and 12. Secure each end with a press-on clamp (P/N 4104161 x2). Install an O<sub>2</sub> label (P/N 4109871 x2) on each end of this tube.
  98. Cut the flex tubing two inches above the hose barb on the top of the air OFPD and install a nylon tee fitting (P/N 4102337) as shown in Figure 12. Install an O<sub>2</sub> label (P/N 4109871 x2) on each end of this junction.

# INSTALLATION PROCEDURE (continued)



**Figure 12: FLEX TUBING CONNECTIONS**

**INSTALLATION PROCEDURE (continued)**

99. Connect a 6 in. length of flex tubing (P/N ML08003 x6) to the side port of the nylon tee installed in the previous step. Connect the other end of this tube to hose barb on the top of the CO<sub>2</sub> OFPD, and secure this connection with a press-on clamp (P/N 4104161). Secure all nylon tee fitting junctions with tie straps (P/N 4106068 x3). Install an O<sub>2</sub> label (P/N 4109871 x2) on each end of the tubing.
100. Connect a 17 in. length of flex tubing (P/N ML08003 x17) from the remaining port of the nylon tee fitting in the vapor box and secure it with a tie strap (P/N 4106068). Connect the other end of the tubing to the side port "A" on the 4-way fitting and secure it with a press-on clamp (P/N 4104161). Install an O<sub>2</sub> label (P/N 4109871 x2) on each end of this tube. See Figure 12.
101. Remove the existing tubing from side port "B" on the 4-way fitting. Connect an 8 in. length of flex tubing (P/N ML08003 x8) from side port "B" on the 4-way fitting to the bottom port of the minimum flow valve, and secure each connection with a press-on clamp (P/N 4104161 x2). Install an O<sub>2</sub> label (P/N 4109871 x2) on each end of this tube. See Figure 12.
102. Cut the tie strap securing the flex tubing on the side port of tee fitting "C" in the flowmeter housing and remove the tubing.
103. Connect a 10 in. length of flex tubing (P/N ML08003 x10) to the side port of nylon tee fitting "C", and secure it with a tie strap (P/N 4106068). Connect the other end of the tubing to the side port of the minimum flow valve, and secure it with a press-on clamp (P/N 4104161). Install an O<sub>2</sub> label (P/N 4109871 x2) on each end of this tube.
104. Reconnect the flex tubing previously removed from the hose barb located below the O<sub>2</sub> flow control valve, and secure the connection with the press-on clamp previously removed. Verify that an O<sub>2</sub> label is attached to each end of this hose.
105. Reconnect the flex tubing previously removed from the hose barb located below the N<sub>2</sub>O flow control valve, and secure the connection with the press-on clamp previously removed. Verify that a N<sub>2</sub>O label is attached to each end of this hose.
106. Connect the Air pipeline supply hose to the machine.
107. Install a CO<sub>2</sub> cylinder in the new yoke. Verify the presence of two index pins on the yoke assembly and the correct engagement with the cylinder index holes. Open one cylinder valve each of Oxygen, Nitrous Oxide and CO<sub>2</sub>.
108. Close the N<sub>2</sub>O flow control valve; ensure that all other valves are fully open.

## INSTALLATION PROCEDURE (continued)

109. Turn the System Power switch ON, and depress the rear gas selector valve to flush any debris from the new piping, and return the switch to the STANDBY position.
110. Install the CO<sub>2</sub> restrictor housing (P/N 4103440) with a yellow restrictor (P/N 4110738-006) and O-ring (P/N 4101872) as shown in Figure 14.
111. Place gaskets (P/N 4102724 x2) on top of the CO<sub>2</sub> restrictor housing and in the insert at the top flowmeter block for CO<sub>2</sub>.
112. Carefully install the CO<sub>2</sub> flowtube (P/N 4112557-001) with the CO<sub>2</sub> marking facing forward as shown in Figure 14.
113. Install the AIR restrictor housing (P/N 4103440) with an O-ring (P/N 4101872) as shown in Figure 14.
114. Place gaskets (P/N 4102724 x2) on top of the AIR restrictor housing and in the insert at the top flowmeter block for AIR.
115. Carefully install the AIR flowtube (P/N 4112558-001) with its AIR marking facing forward as shown in Figure 14.
116. Close the AIR and CO<sub>2</sub> flow control valves.
117. Reinstall the O<sub>2</sub> restrictor assembly that was previously removed from the bottom flowmeter block.
118. Carefully reinstall the O<sub>2</sub> fine flowtube with the O<sub>2</sub> marking facing forward.
119. Turn the System Power switch to ON to flush any debris from the new piping, and return the switch to the STANDBY position.
120. Carefully reinstall the O<sub>2</sub> coarse flowtube with the O<sub>2</sub> marking facing forward as shown in Figure 14.
121. Turn the System Power switch ON to flush any debris from the new piping, and return the switch to the STANDBY position.
122. Reconnect the flex tubing previously removed from the N<sub>2</sub>O restrictor assembly and verify that the connection is secured with a press-on clamp.
123. Reinstall the N<sub>2</sub>O restrictor assembly that was previously removed from the bottom flowmeter block.
124. Turn the System Power switch ON. Set the O<sub>2</sub> flow to 4 l/min. Open the N<sub>2</sub>O flow control valve fully to its stop to flush any debris from the new piping. Return the System Power switch to STANDBY.
125. Carefully reinstall the N<sub>2</sub>O fine flowtube with the N<sub>2</sub>O marking facing forward as shown in Figure 14.
126. Turn the System Power switch ON to flush any debris from the new piping, and return the switch to the STANDBY position. Close the N<sub>2</sub>O flow control valve.

# INSTALLATION PROCEDURE (continued)

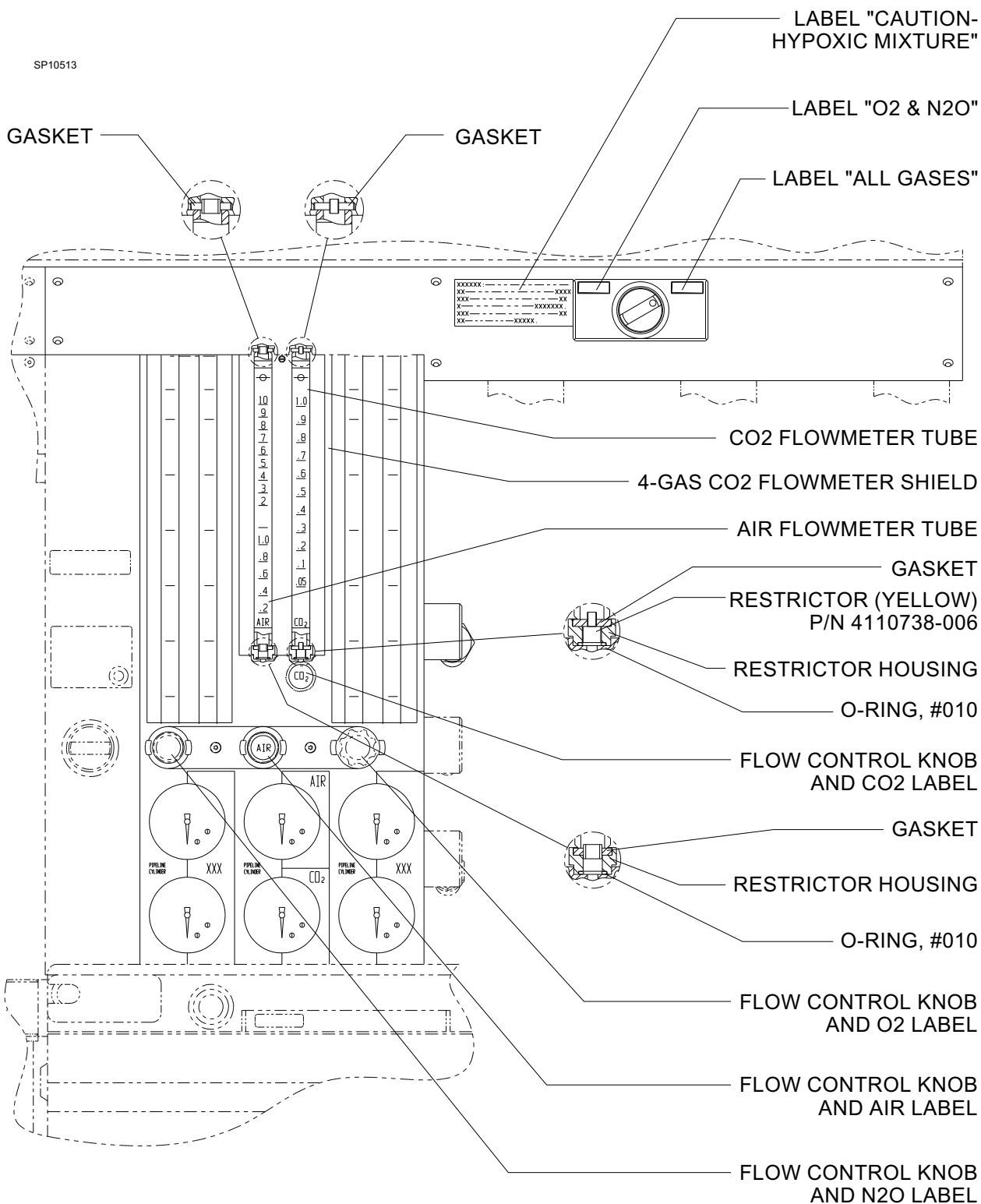


Figure 13: AIR AND CO<sub>2</sub> FLOWTUBE INSTALLATION

<b>INSTALLATION PROCEDURE (continued)</b>
---

- |   |   |
|---|---|
| <p>127. Carefully reinstall the N<sub>2</sub>O coarse flowtube with the N<sub>2</sub>O marking facing forward as shown in Figure 14.</p> <p>128. Slide the 4-gas flowmeter lights PCB (P/N 4110857) into the flow lights channel (P/N 4110582) and attach the wire harness to the assembly. (The black wire is connected to the terminal at the back of the PCB.) Insert the assembly into the shoulder studs at the center flowmeter. Reinstall the remaining lights in the same manner.</p> <p>129. Install the 4-gas flowmeter shield (P/N 4110587-004).</p> <p>130. Reattach the 3-gas flowmeter knob guard to the flowmeter assembly reusing the hardware previously removed.</p> <p>131. Use the appropriate vapor box front plate (P/N 4111510 or 4111520) on machines with a multigas analyzer. Assemble the gas selector switch cam assembly (consisting of P/Ns 4111693, 4103169, 4103423, 4108461, 4108462, 4109866, and 4109867) to the new vapor box front panel with two 8-32 x 3/8 in. socket head screws (P/N HW01012 x2) and lock washers (P/N HW67000 x2). See Figure 13.</p> <p>132. If applicable, attach the vapor indicator PCB assembly to the front panel with the hardware that was previously removed. Restore all wire connections to the vapor indicator PCB.</p> | <p>133. Install the vapor box front panel and ensure that the selector switch cams operate the gas select valves correctly. Set the selector to the ALL GAS position. Attach a HYPOXIC MIXTURE label (P/N 4110953) to the left of the gas selector switch. If applicable, apply arrow indicator labels (P/N 4112055 x3) at the three locations shown in Figure 13.</p> <p>134. Reinstall the angled front plate at the top of the flowmeter shield reusing the hardware previously removed. On earlier machines this plate is retained by two screws inside the flowmeter housing. (On later machines with a one-piece plate, this plate was installed in the previous step as part of the vapor box front cover.)</p> <p>135. Install the AIR and CO<sub>2</sub> flow knobs (P/N 4103736 x2) and reinstall the N<sub>2</sub>O and O<sub>2</sub> flow knobs.</p> <p>136. Turn the System Power switch ON. Set the Gas Selector switch to ALL GAS. Verify that the O<sub>2</sub>, N<sub>2</sub>O, AIR, and CO<sub>2</sub> flowmeters operate properly over their full range. Close all flow control valves.</p> <p>137. Connect the 15 mm connector to a Capnomed flowmeter test stand and verify that each "off stop" is properly set. Readjust the stops as necessary. Remove the test flowmeter. Turn the System Power switch ON. Verify that all flow meters operate properly over their full range.</p> |
|---|---|

INSTALLATION PROCEDURE (continued)

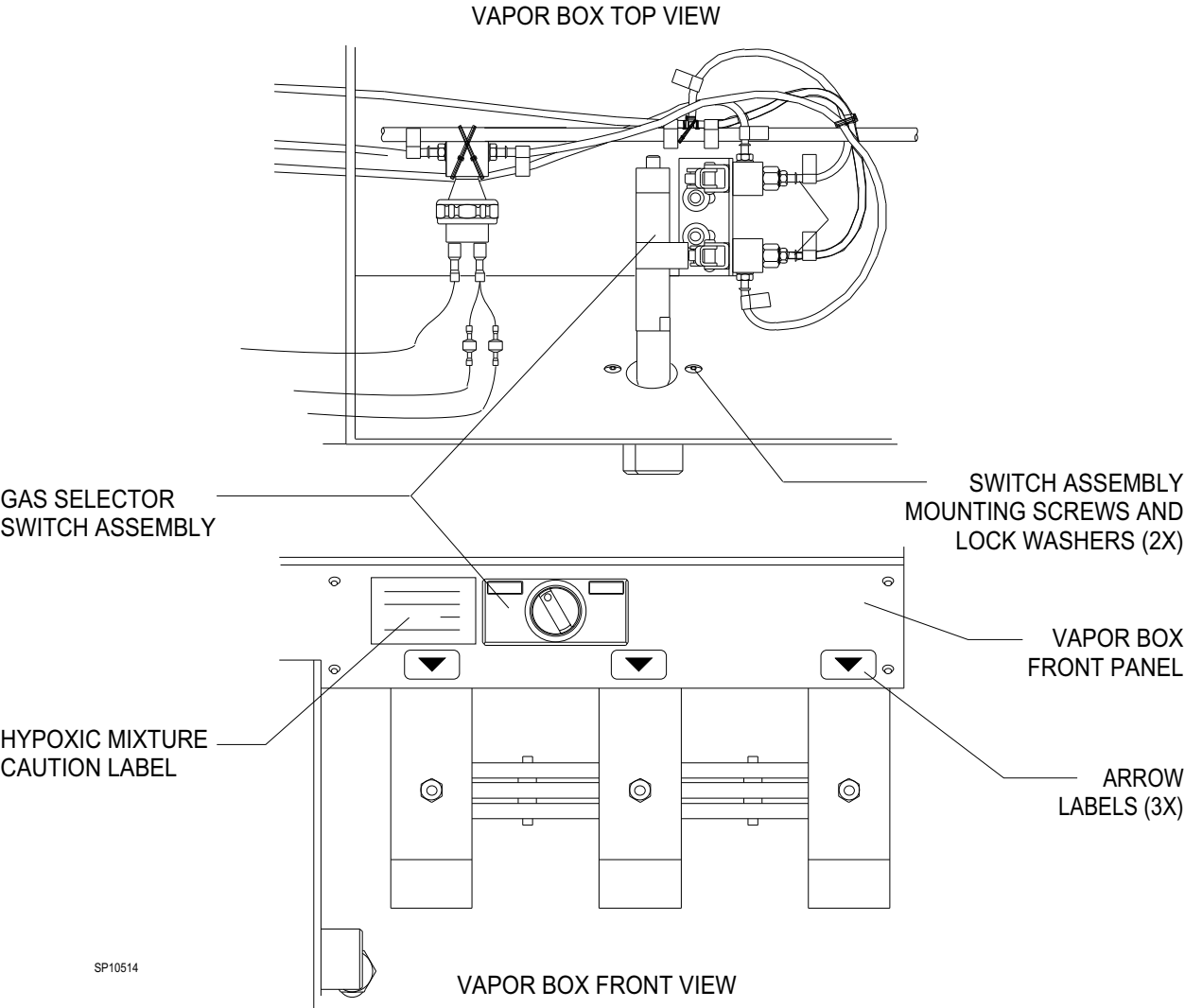
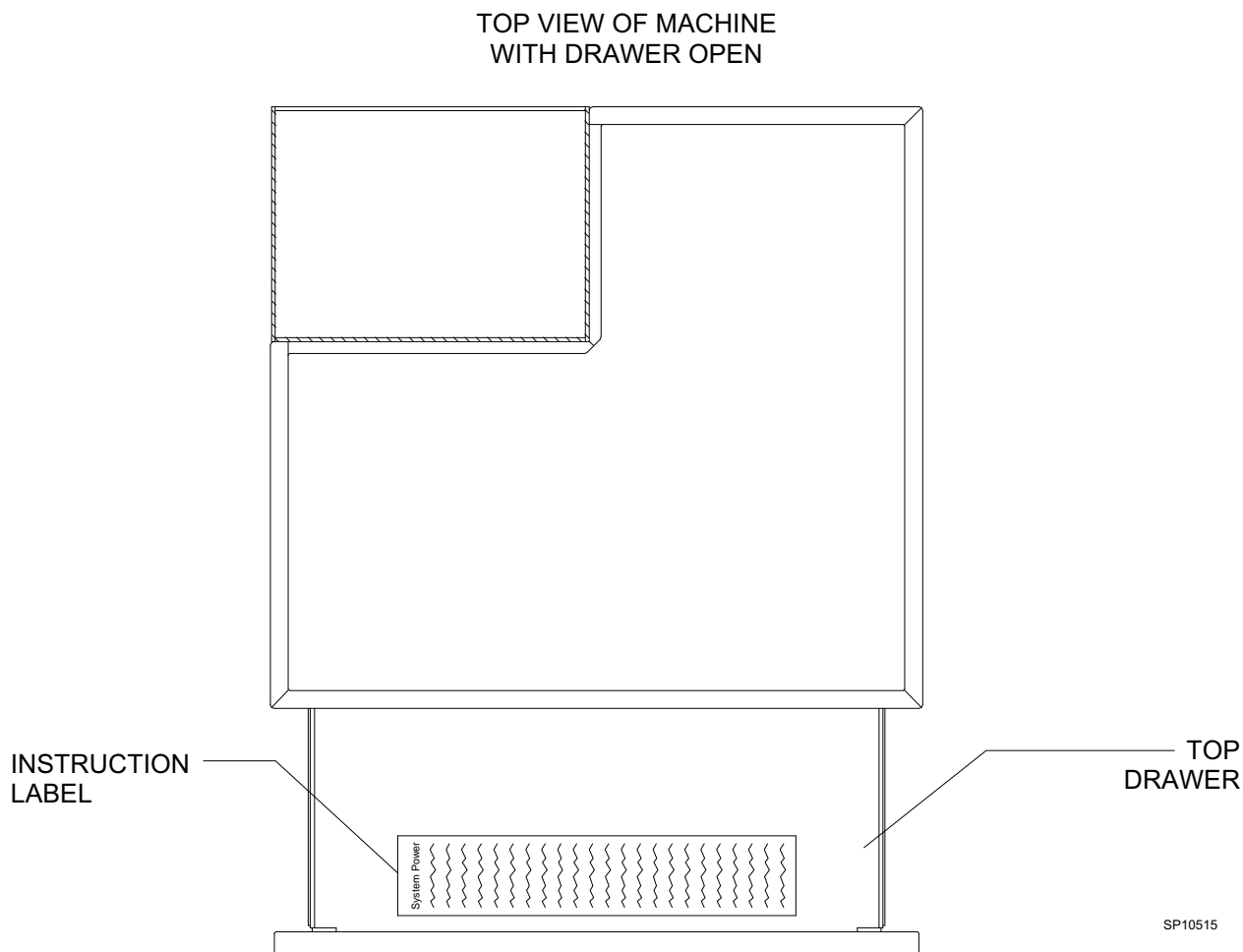


Figure 14: GAS SELECTOR SWITCH ASSEMBLY

## INSTALLATION PROCEDURE (continued)

138. Enable the circuit breakers and connect AC power to the machine.
139. Remove any existing labels from the flowmeter knobs. Install the correct label (P/Ns 4103905, 4103908, 4103904, and 4103178) on each flowmeter knob.
140. Attach a new instruction label (P/N 4104818) to the inside of the top drawer as shown in Figure 15.



**Figure 15: NEW INSTRUCTION LABEL LOCATION**



<b>CO<sub>2</sub> AND AIR CIRCUIT ADJUSTMENT AND TEST</b>
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**1.0 CYLINDER PRESSURE REGULATOR ADJUSTMENT**

- 1.1     Open the CO<sub>2</sub> flow control valve to the full open position.
- 1.2     Loosen or remove the acorn nut from the CO<sub>2</sub> regulator.
- 1.3     Turn the System Power switch to ON.
- 1.4     Set the Gas Select switch to the ALL GAS position.
- 1.5     Open the O<sub>2</sub> and CO<sub>2</sub> cylinder valves.
- 1.6     Turn the CO<sub>2</sub> regulator adjustment screw until the CO<sub>2</sub> flowmeter indicates a flow rate of 550 ml/min.

Replace the acorn nut on the regulator.

**2.0 HIGH PRESSURE CYLINDER LEAK TEST**

- 2.1     Turn the System Power switch to STANDBY.
- 2.2     Open all cylinder valves and allow the gauge pressures to stabilize.
- 2.3     Close all cylinder valves and remove all cylinders from their yokes. If applicable, close the Auxiliary O<sub>2</sub> flowmeter valve.  
  
Observe the cylinder pressure gauges. The pressure should not drop more than 50 psi over the next two minutes.
- 2.4     Reattach the cylinders to the yokes.
- 2.5     Turn the System Power switch to ON and repeat the high pressure leak test.

## CO<sub>2</sub> AND AIR CIRCUIT ADJUSTMENT AND TEST (continued)

### 3.0 LOW PRESSURE LEAK TEST

- 3.1 Ensure that all flow control valves are closed.
- 3.2 Turn the System Power switch to STANDBY.
- 3.3 Remove the 15mm connector from the FRESH GAS OUTLET. Connect a test gauge and B.P. bulb to the fresh gas outlet, and pressurize the system to 50 cm H<sub>2</sub>O.
- 3.4 The pressure should not drop more than 10 cm H<sub>2</sub>O in thirty seconds.
- 3.5 Disconnect the test gauge. Reconnect the 15mm connector to the FRESH GAS OUTLET.

### 4.0 OFPD TESTS

- 4.1 Turn the System Power switch to ON.
- 4.2 Open the O<sub>2</sub>, N<sub>2</sub>O, and CO<sub>2</sub> cylinder valves.
- 4.3 Set the O<sub>2</sub>, N<sub>2</sub>O, and AIR flow rates to 1.0 l/min.; set the CO<sub>2</sub> flow rate to 500 ml/min.
- 4.4 Close the O<sub>2</sub> cylinder valve. When the oxygen flow stops, the N<sub>2</sub>O, AIR and the CO<sub>2</sub> flows must also drop to zero.

### 5.0 FLOWMETER TEST

- 5.1 Open the O<sub>2</sub> cylinder valve.
- 5.2 Adjust the flow of AIR over the full range of the flowmeter. The float should move freely over the entire range.
- 5.3 Adjust the flow of CO<sub>2</sub> to the maximum position. The flow should be between 500 and 600 ml/min. If the flow is not correct, repeat test procedure 1.0 (cylinder pressure regulator adjustment).
- 5.4 Adjust the O<sub>2</sub> flowmeter to 3 l/min.
- 5.5 Adjust the flow of N<sub>2</sub>O over the full range of the flowmeter. The float should move freely over the entire range.

### 6.0 GAS SELECTOR SWITCH TEST

- 6.1 With the switch in the ALL GAS position, open all of the flow control valves and verify that all gases are able to flow.
- 6.2 Turn the Gas Select switch to O<sub>2</sub> + N<sub>2</sub>O. The flow of AIR and CO<sub>2</sub> should stop.
- 6.3 Close all of the flow control valves. There should be a minimum oxygen flow.
- 6.4 Turn the Gas Select switch to ALL GAS. The minimum flow should stop.

**CO<sub>2</sub> AND AIR CIRCUIT ADJUSTMENT AND TEST (continued)**

**7.0 OXYGEN CONCENTRATION  
VERIFICATION TEST**

- |      |  |      |  |
|------|--|------|--|
| 7.1  | Connect a 22mm hose between the bellows VENTILATOR HOSE and the inspiratory valve terminals.         | 7.12 | Verify that the O <sub>2</sub> concentration is between 71% and 77% within 3 minutes.  |
| 7.2  | Activate the waste gas scavenger.  | 7.13 | Close the AIR flow control valve.  |
| 7.3  | Set the Manual/Automatic valve to BAG.   | 7.14 | Set the O <sub>2</sub> flow to 1 l/min.  |
| 7.4  | Occlude the bag mount.   | 7.15 | Set the CO <sub>2</sub> flow to 500 ml/min.  |
| 7.5  | Insert the sensor from a calibrated O <sub>2</sub> Med into the valve dome on the inspiratory valve. | 7.16 | Verify that the O <sub>2</sub> concentration is between 64% and 70% within 3 minutes.  |
| 7.6  | Set the O <sub>2</sub> flow to 4 l/min.  | 7.17 | Close the CO <sub>2</sub> and O <sub>2</sub> flow control valves.                      |
| 7.7  | Verify that the O <sub>2</sub> concentration is between 97% and 100% within 3 minutes.               | 7.18 | Remove the occlusion from the bag mount.   |
| 7.8  | Set the N <sub>2</sub> O flow to 2 l/min.  | 7.19 | Remove the 22mm hose from the bellows VENTILATOR HOSE and inspiratory valve terminals. |
| 7.9  | Verify that the O <sub>2</sub> concentration is between 64% and 70% within 3 minutes.                |      |  |
| 7.10 | Close the N <sub>2</sub> O flow control valve.   |      |  |
| 7.11 | Set the AIR flow to 2 l/min.   |      |  |

## CO<sub>2</sub> AND AIR CIRCUIT ADJUSTMENT AND TEST (continued)

### 8.0 ORMC TEST

#### NOTE:

If the alarm channel on the machine does not have an O<sub>2</sub>/N<sub>2</sub>O alarm lamp, disregard the alarm functions in the following tests.

- 8.1 Fully open the N<sub>2</sub>O flow control valve. Slowly open and close the O<sub>2</sub> flow control valve, and observe that the ORMC is controlling the flow of nitrous oxide. There should be no ORMC alarm with the Gas Select switch in the ALL GAS position.
- 8.2 Turn the Gas Select switch to O<sub>2</sub> + N<sub>2</sub>O. Slowly open and close the O<sub>2</sub> flow control valve, and observe that the ORMC is controlling the flow of nitrous oxide. The ORMC alarm should function correctly with the Gas Select switch in the O<sub>2</sub> + N<sub>2</sub>O position.

### 9.0 RE-ASSEMBLY & FINAL TESTING

- 9.1 Close all cylinder valves except the O<sub>2</sub> cylinder valve.
- 9.2 Set the O<sub>2</sub> flow rate to 5 l/min.
- 9.3 Open the N<sub>2</sub>O flow control valve to drain pressure from the system.
- 9.4 Close the O<sub>2</sub> cylinder valve, open the O<sub>2</sub> flow control valve, and press the O<sub>2</sub> FLUSH button to drain pressure from the system.
- 9.5 Turn the System Power switch to STANDBY.
- 9.6 Reinstall the table top on the machine.
- 9.7 Reinstall the vapor box back cover and the flowmeter housing back cover.
- 9.8 Perform a complete PMS procedure on the machine.



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